The previous stand instructions let you build a simple stand that will work for basic functions, and is satisfactory for larger domes. However, for small domes (12”-15” in diameter), I’ve come up with an alternate advanced design that can be used in several different useful configurations:

1. Portable mode. Fits into a backpack or Pelican case, sits flat on a surface.

2. Stand mode. Dowel legs raise it above the ground, but an opening in the bottom allows for easy placement of low-profile objects.

3. Micrometer mode. A small microscope micrometer stage allows for accurate positioning of objects when doing macro or microscopic photography.

4. Open mode. The center piece is removed, and the object is positioned using a lab jack or similar stand. This allows the surfaces of thicker objects to be imaged.

5. Vertical mode. The dome is held upright, allowing the surfaces of larger object to be imaged (like pots, paintings, etc.).

Here’s a video that demonstrates the use modes of this stand.

This stand design requires a bit more work to construct than the simple one, but the extra effort is worthwhile because of the expanded flexibility. If you know someone with woodworking skills and tools, I’d suggest buying them a six-pack to help you build it; as you’ll see, my lack of those skills resulted in some less than optimal hacks to put it together (but it still works).

You will need the following:

2 flat square pieces of wood or MDF, at least the outer dimension of your dome including the flange. The dome I’m using here is a 12” diameter plus 0.75” flange around the edge, for a total outer dimension of 13.5”. I used 13.625” square MDF pieces, just to play it safe. 0.5” thickness.

4 wooden dowel pieces 6” in length, 1” to 1.25” in diameter. Soft wood (e.g. pine) is preferable.

Vibration-dampening material (for the bottom of the dowel pieces.

2 wooden pieces 0.75” to 1” square by approx. 3” to 4” in length; exact length will depend on the size of the dome (see instructions).

8 ¼-20 threaded brass inserts.

8 ¼-20 1” hex bolts

4 ¼-20 metal washers (use with brace bolts)

3 2” long mending plates (http://www.homedepot.com/p/Everbilt-2-in-Zinc-Plated-Mending-Plate-4-Pack-15299/202033910)

2 1.5” utility hinges (http://www.homedepot.com/p/Everbilt-1-1-2-in-Zinc-Plated-Narrow-Utility-Hinge-2-Pack-15396/202034103)

8 3/8” #6 wood screws

3 ½” #6 wood screws

3 #8 ½” machine screws

3 #8 threaded brass inserts

4 #10 machine screws or bolts, 1” long

4 #10 brass knurled nuts

8 #10 metal washers

4 #10 neoprene/rubber washers

Micrometer stage (optional)

1.5” or longer #4 machine screw, with nut/washer (optional for micrometer stage)

Optional pieces to secure stand for transport:

4 1.5” ¼-20 bolts

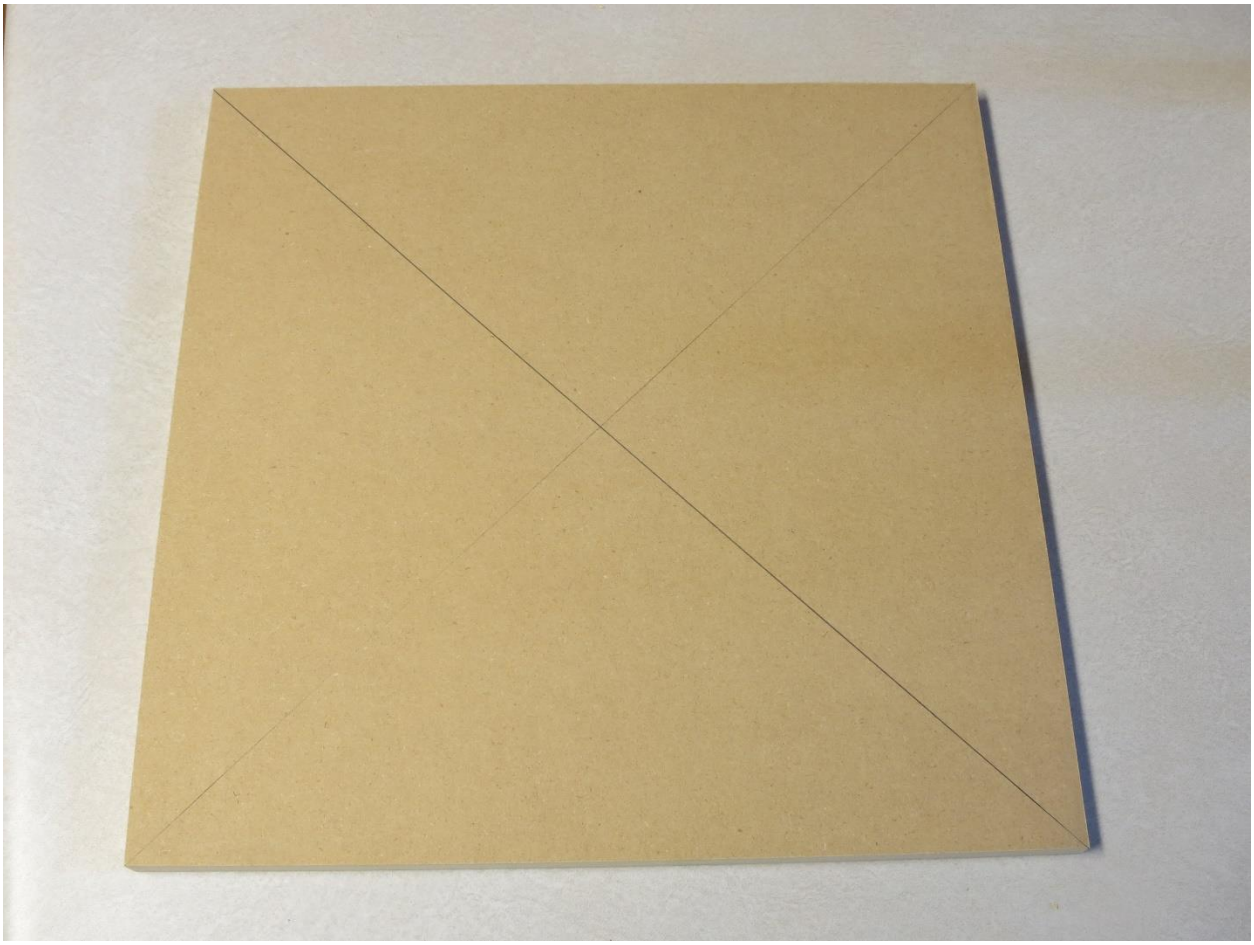
8 ¼-20 washers

4 ¼-20 wing nuts

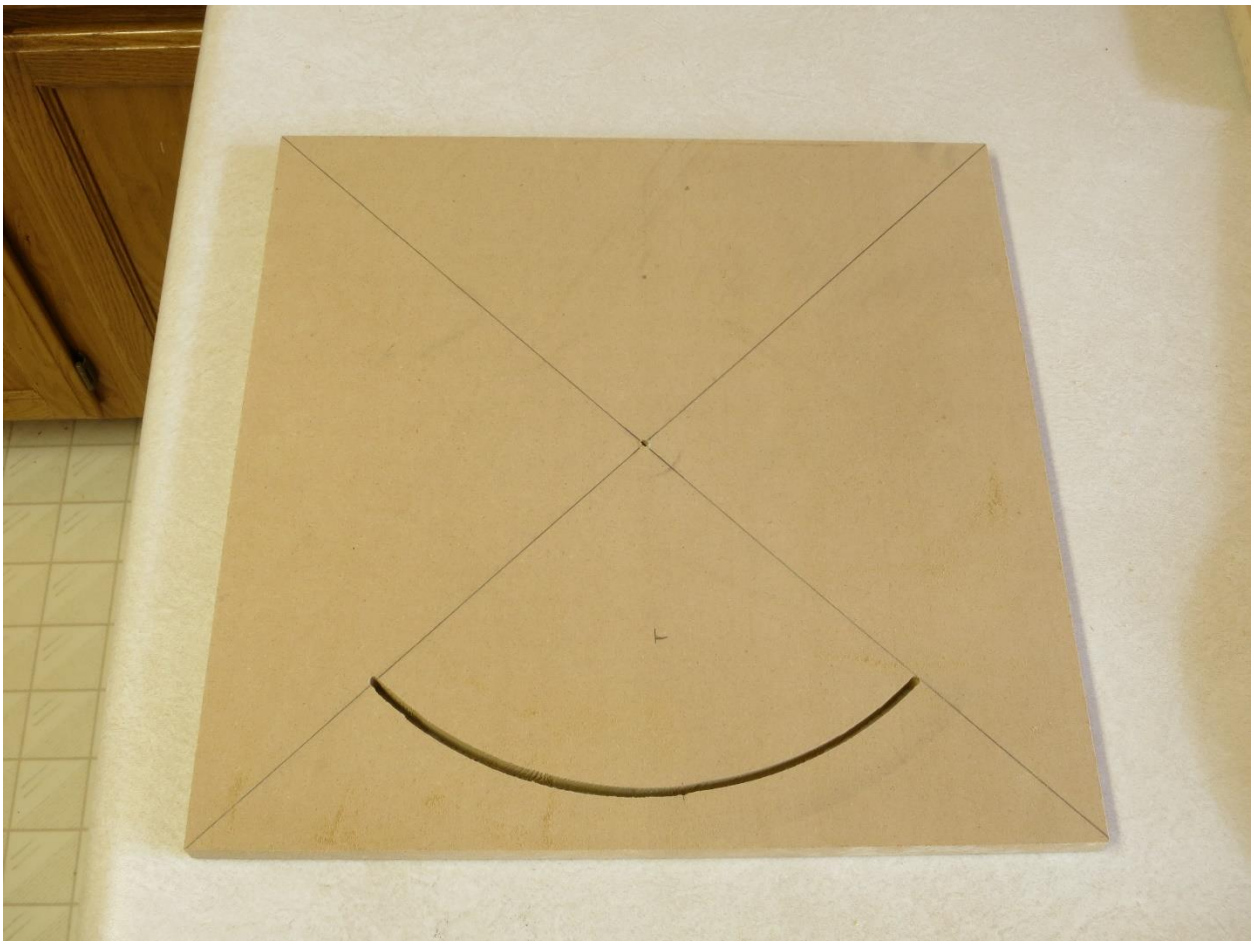
If you find I’ve forgotten something from the instructions, let me know.

Before I begin, a quick note. I made a number of screw-ups in constructing the dome, even though I had a previous version in front of me to act as a model. And, as an added bonus, I also didn't take pictures at every step. So, if the text and the picture conflict, follow the text. Also, read the directions all the way through (and watch the video), and use that as a guide for what you're going to build. If something doesn't make sense right away, read on, hopefully all will become clear.

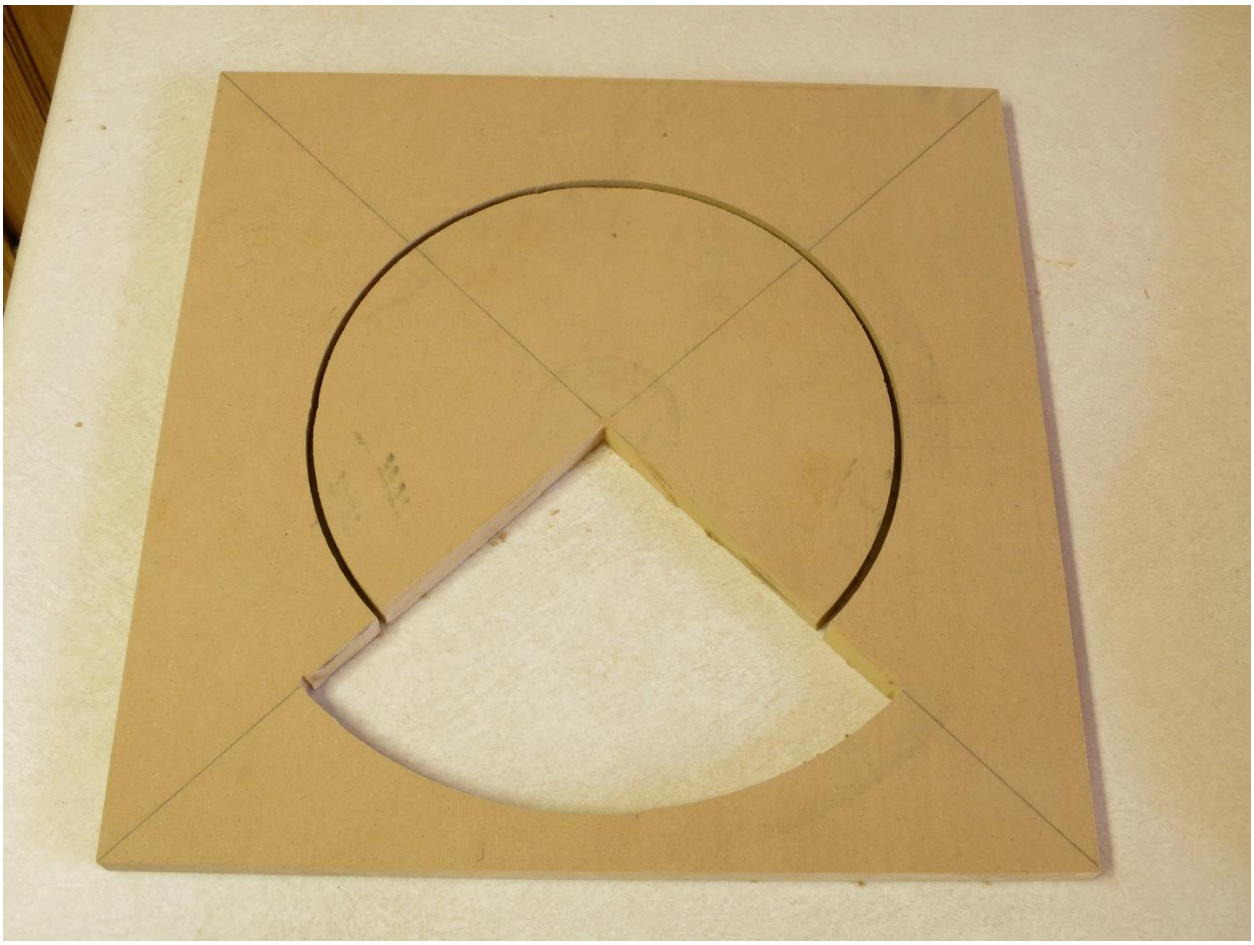
Start with one of the large wood/MDF squares:



Draw lines between opposite corners to find the center point at the intersection. Draw an arc with radius equal to the inner dome diameter between two of the diagonals, not including the flange, and cut along that arc; for my 12" diameter dome, that's a 6" radius:



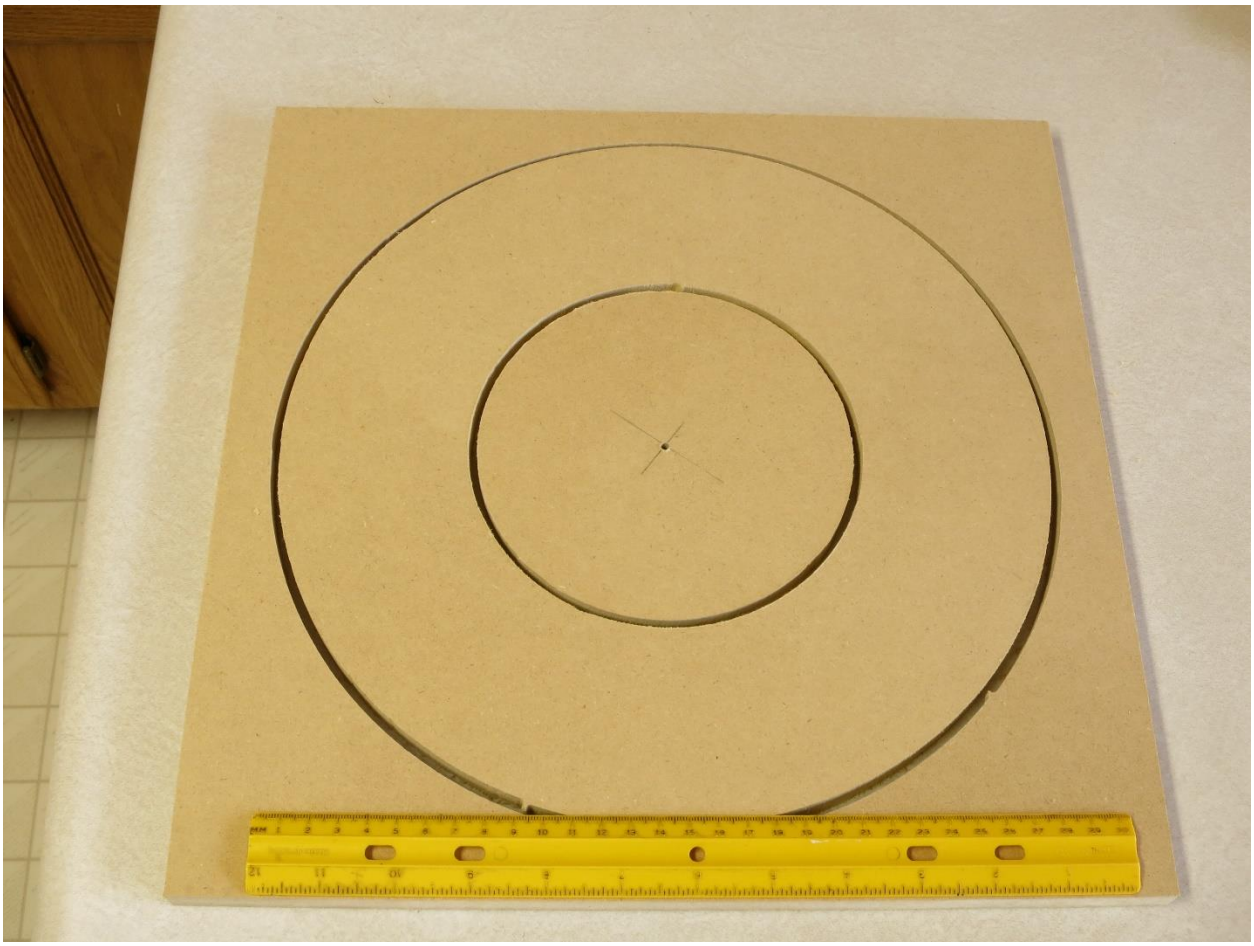
Now draw a circle with a radius 1.5” less than the inner dome diameter (4.5” in this case), and cut out a circle from the center. Then, cut out a ¼ radial slice from both the circle, and the remaining board:



The reason for this slice is to create an opening to allow you to put samples under the dome, and also manipulate the optional micrometer stage; more on this later. This is the bottom plate and the base of the center plate.

With the other square wood/MDF piece, find the center as before, draw a circle all the way around with the inner dome radius (6” for my 12” dome), and cut the circle out of the wood piece. Then, from the circular piece you’ve just cut out, cut out a circle ½ the diameter of your dome (a 6” circle for me, 3”

radius).



Keep the square (the top plate) and the inner circle; the remaining round ring you can throw out, or find some other use for. This inner circle will be glued to the center plate later.

So you have two cut squares, top and bottom plates:

The dome will be attached to the top piece, and the top and bottom pieces will be connected with the two hinges. Place the dome on top of the top piece above, and mark the positions where the hinges should go so that they're as far from the edge as possible, but won't interfere with the dome:

Here are the two hinges laid in place in their initial positioning on the bottom plate:

You can attach the hinges directly here, but that would cause a small problem. The thickness of the hinges will keep the top and bottom pieces from being parallel to each other; they will be slightly angled, with a gap at the hinged end and no gap at the far end:

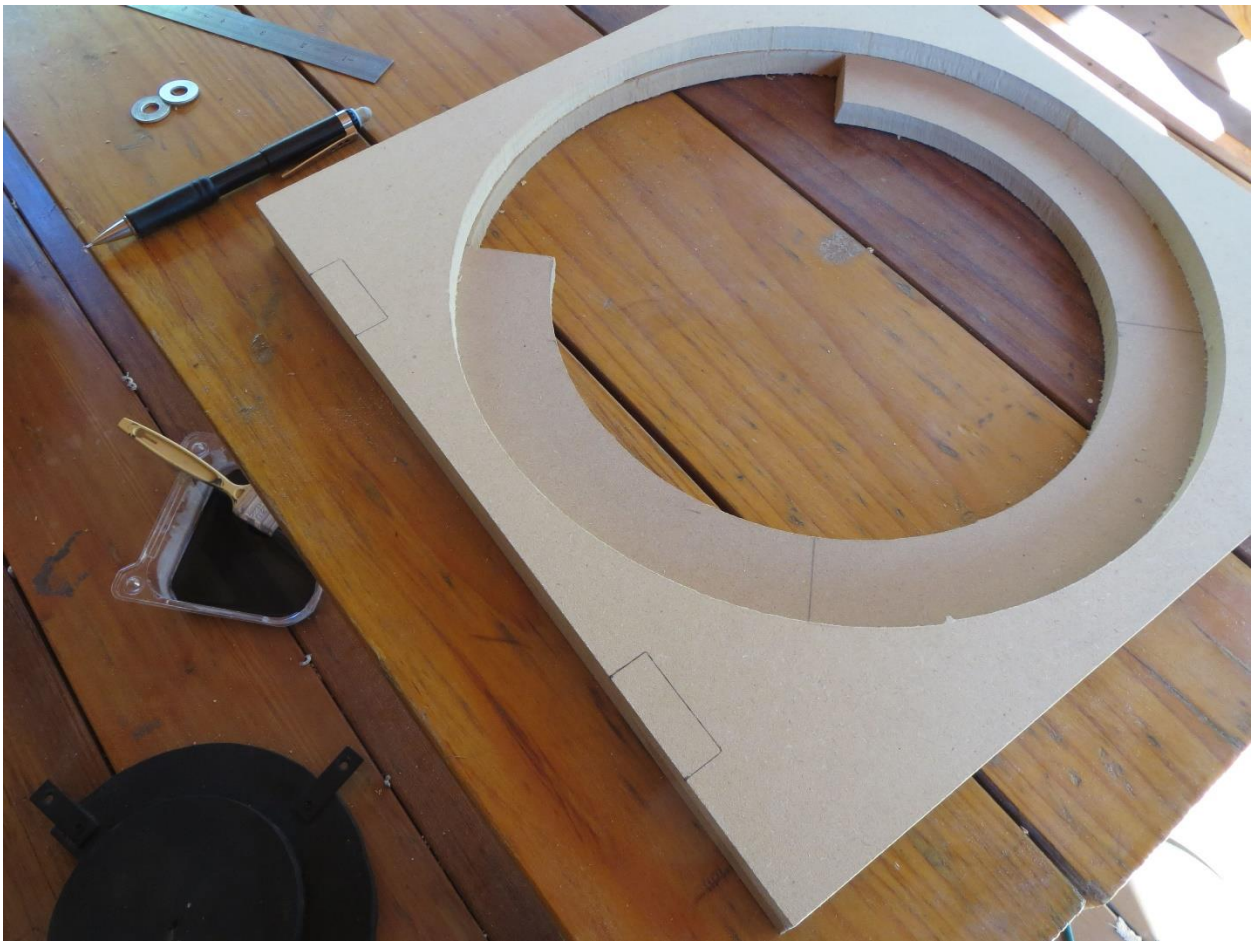
Here’s the hinge end:

And here’s the opposite end:

If you decide to install the hinges this way, you'll need to add spacers at the far end to compensate for this gap, and keep the top and bottom plates parallel. The alternative, which I've been doing, is to mill recesses in the two plates that the hinges will fit into. First I use the dome to draw an arc on the bottom plate, to make sure the hinges will fit:

Then I trace outlines around the edges of the hinges, to mark the places where I need to mill out a recess (as close to the dome as reasonable):

Now use these marks as a guide to creating similar recess marks on the top piece.



I used a Dremel with a mill attachment, along with a depth control guide, to mill out the recesses to the thickness of the hinge plates. Any woodworking hobbyist should have better tools and expertise to do this with. Here are the bottom and top plates, with the hinges in position in the milled recesses:

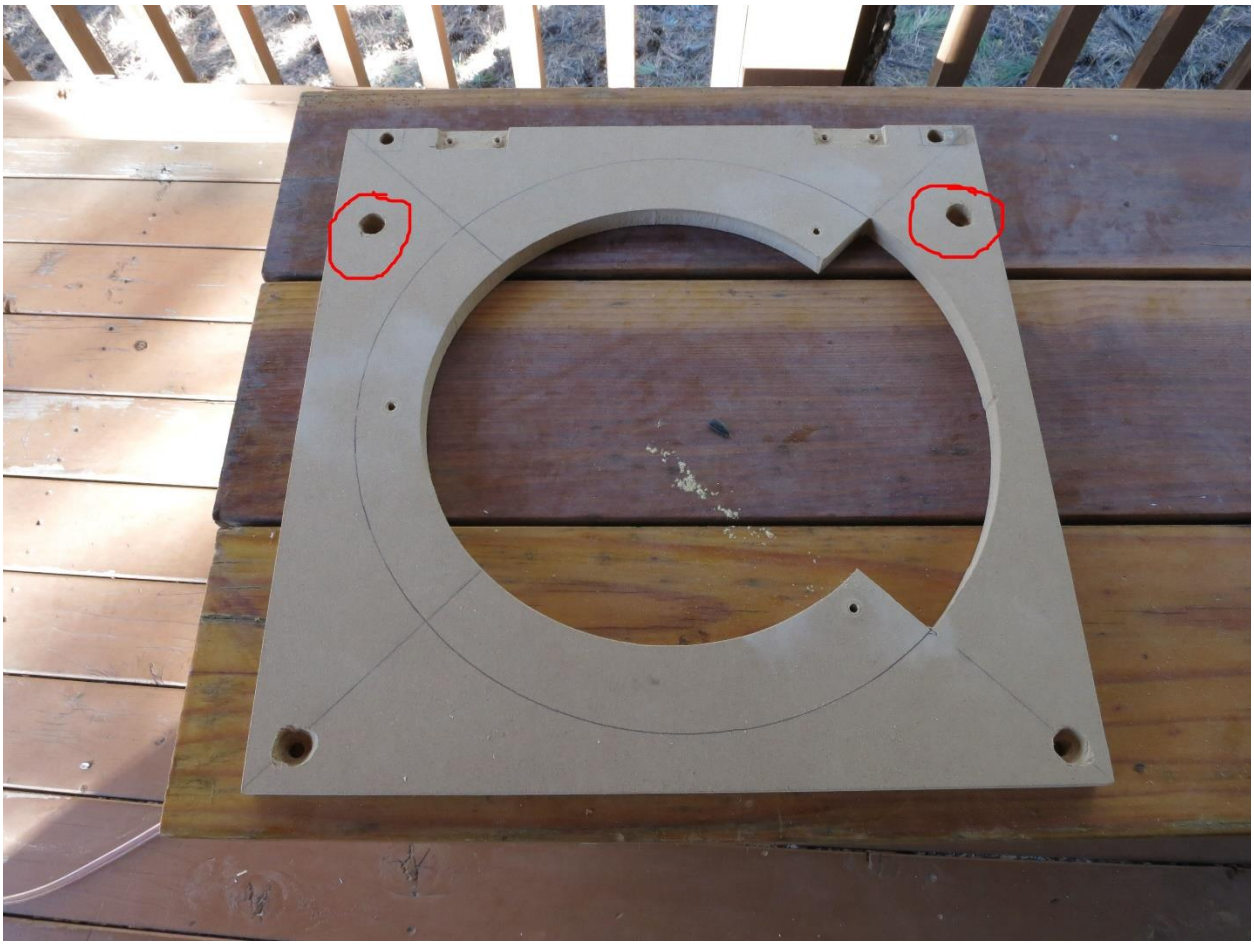
Now use 3/8” #6 wood screws to attach the hinges to the two plates. Do one plate first, then the other one; try and line the plates up so that the hinge edges are parallel to each other. It can also be helpful to drill a shallow starter hole for the screws.

Flip the plates closed, and check to make sure the plates are flush along their entire length:

Now you need to drill four holes for the stand dowel legs. The two on the far end away from the hinges should be drilled about 1” away from each side, as marked here; you will drill a ¼” hole through both plates:

The next picture shows the four dowel holes drilled through both plates.

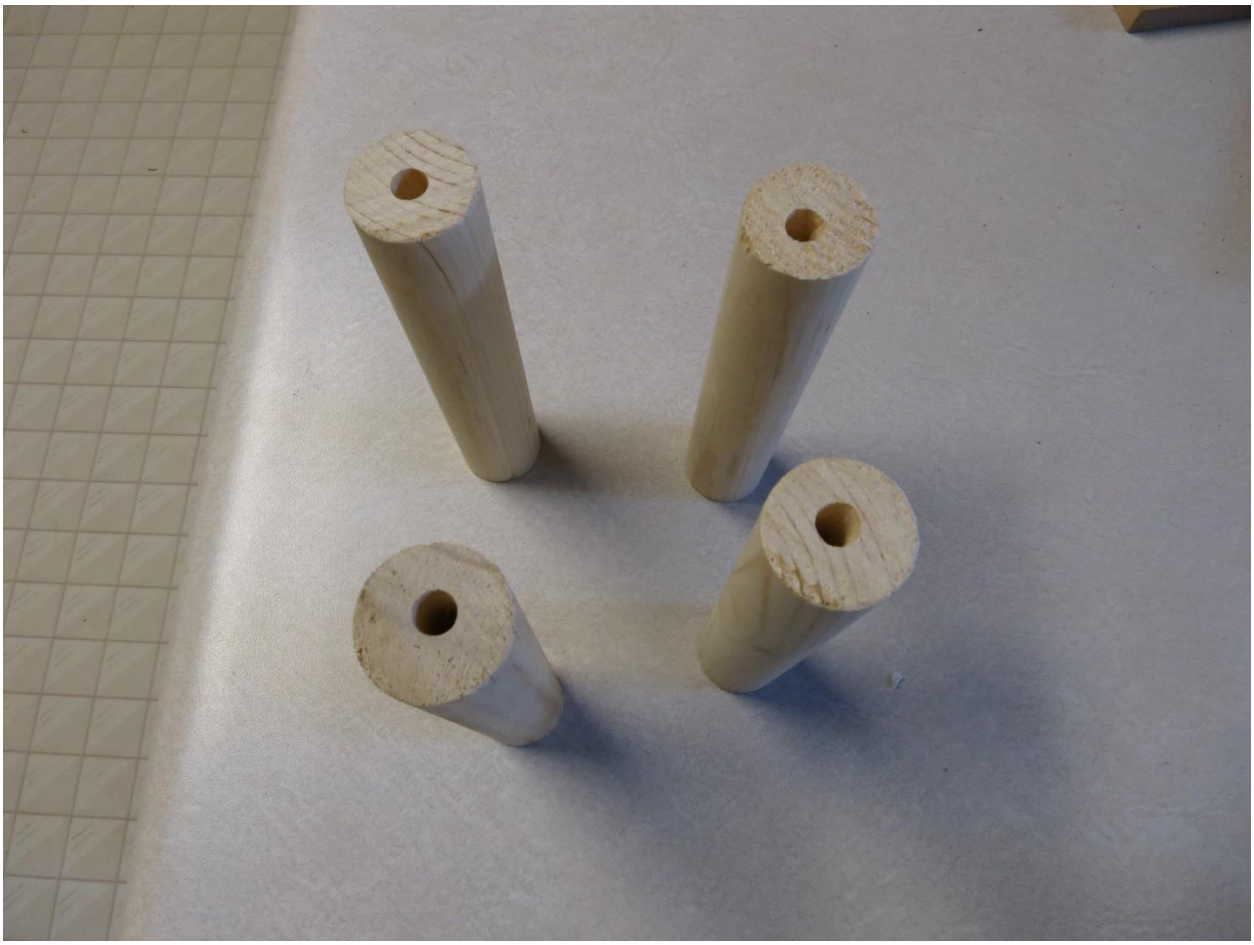
The holes furthest from the hinges are in the correct positions; the holes nearest the hinges were drilled incorrectly. You want these near-hinge holes to be about 1” from the side, but about 2.5” from the back edge. This is to give room for the square braces necessary to hold the top plate vertically in one mode, and create a hole to hold the square brace (see the last part of the video for an example of this). Here’s the bottom plate with the circled near-hinge holes in the correct position (ignore the other holes for now):



Once you've drilled these holes, unscrew the bottom plate from the hinges; you can leave them attached to the top plate.

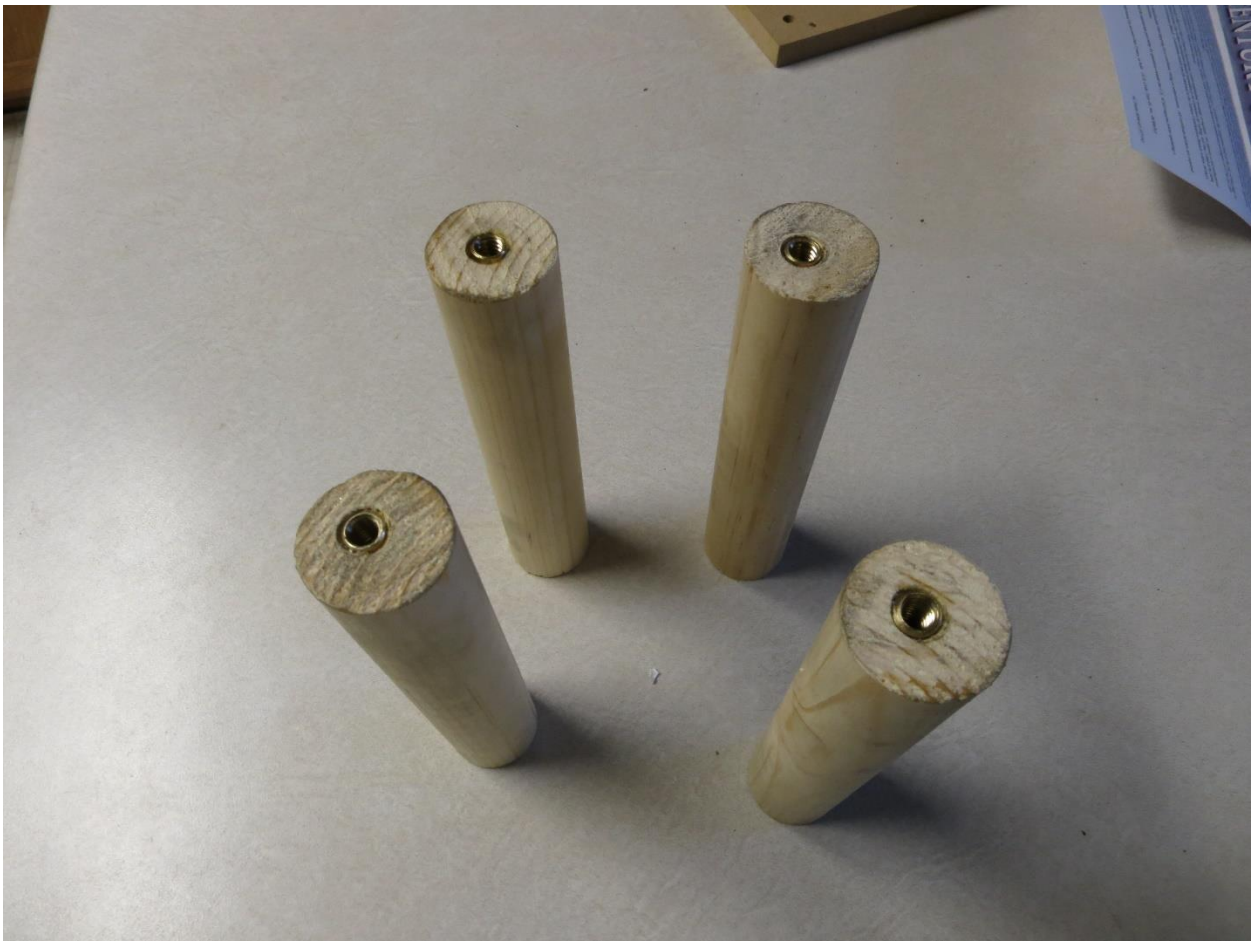
Now take the 4 6"-long dowel pieces, and drill a hole in the center of one end for the threaded brass insert. For these dowels, I used the brass insert type on the left (externally threaded), which requires a 5/16" hole in the dowels; you can also use press-fits, like the one on the right, which I used for the simple stand:

It's best to drill a starter hole first, then work your way with increasingly larger drill bits to the 5/16” size:



The slotted end of the threaded insert goes down into the dowel hole first. Do a Google search for recommendations on the best way to install these. The way I used was to take a 1.5” ¼-20 bolt, thread a nut on it first, then screw the insert on the end of the bolt until it touches the nut. Clamp the dowel securely, then use a socket driver to start threading the insert into the hole, using firm downward pressure. Once you get it started, use a wrench on the nut to continue screwing the insert into the dowel. Once the insert is fully in the dowel, hold the bolt steady with a socket driver, and use a wrench to loosen the nut. You should then be able to unscrew the bolt/nut with the socket wrench. If you only use a bolt, no nut, what will most likely happen is that you will screw the insert in all the way, but it will get stuck on the insert; when you try to unscrew the bolt, the insert will come out of the dowel, and you’ll find it difficult to impossible to remove the insert from the bolt.

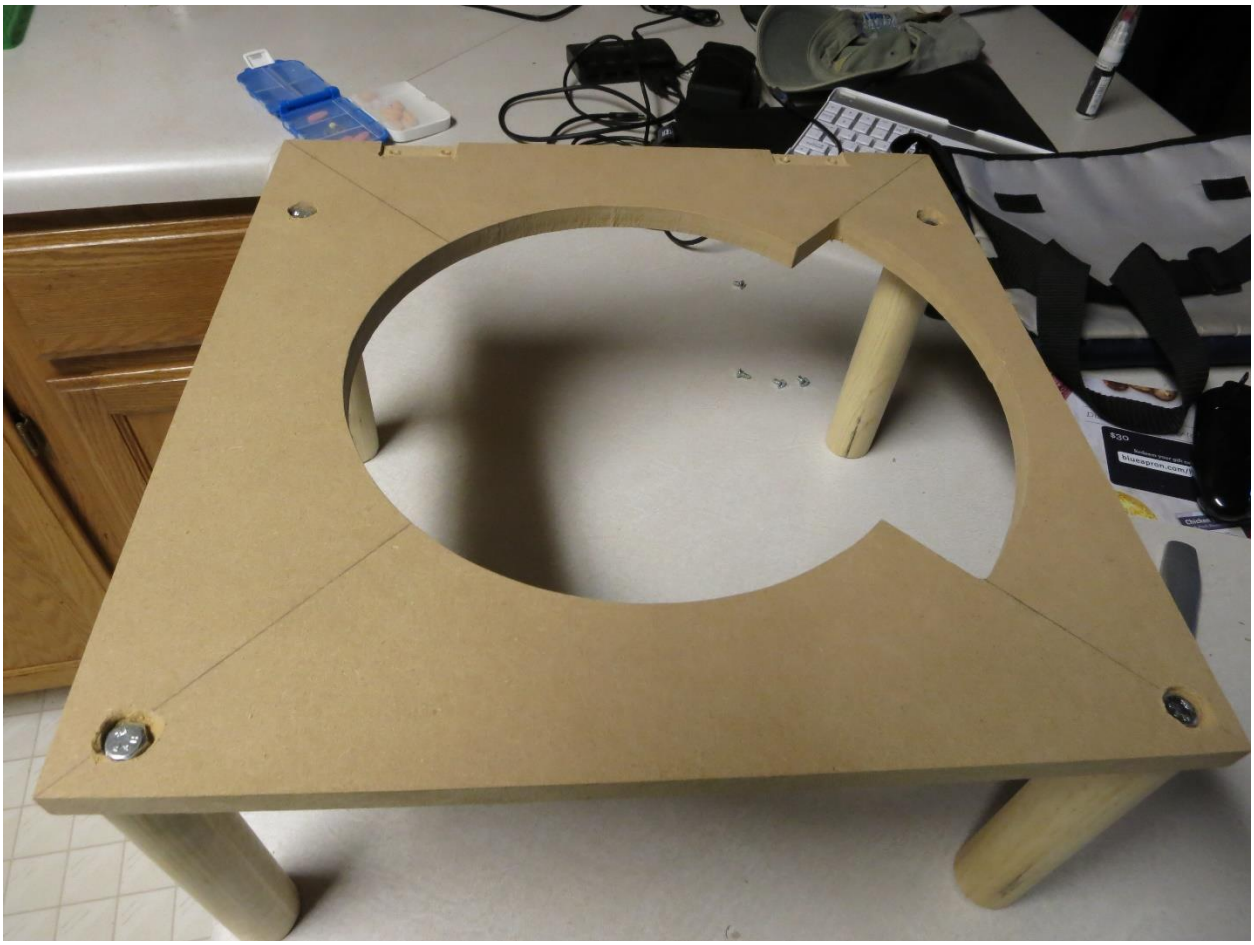
So here are the four dowels with the inserts in them:



You can attach the dowels legs now to the bottom plate with ¼-20 bolts, as with the simple stand, but the heads of the bolts will stick out and keep the top plate from being flat against the bottom plate. To get around this, drill ½” countersink holes in the bottom plate that the bolt heads will fit into:

I used a ½” drill bit to create these, which is why they look so horrible. You can buy ½” countersink bits, or you can ask your friendly neighborhood woodworking expert to make them for you. The ¼-20 bolt heads should now fit inside these countersinks, flush with or below the surface of the bottom plate:

Repeat the process with all four holes in the bottom plate, and check that the dowels fit:



Next, you'll be drilling the holes needed to attach the dome to the top plate. Start by marking the positions for four holes on the top plate; you'll want them spaced about halfway between the edge of the plate, and the edge of the hole (shaded a bit towards the outside of the plate). Measure carefully to make sure they're centered relative to the edges of the plate:

(Note: the dowel holes near the hinges are in the wrong position here – they got filled in later on, and the correct holes drilled).

Now drill holes at the marked position for #10 machine screws/bolts:

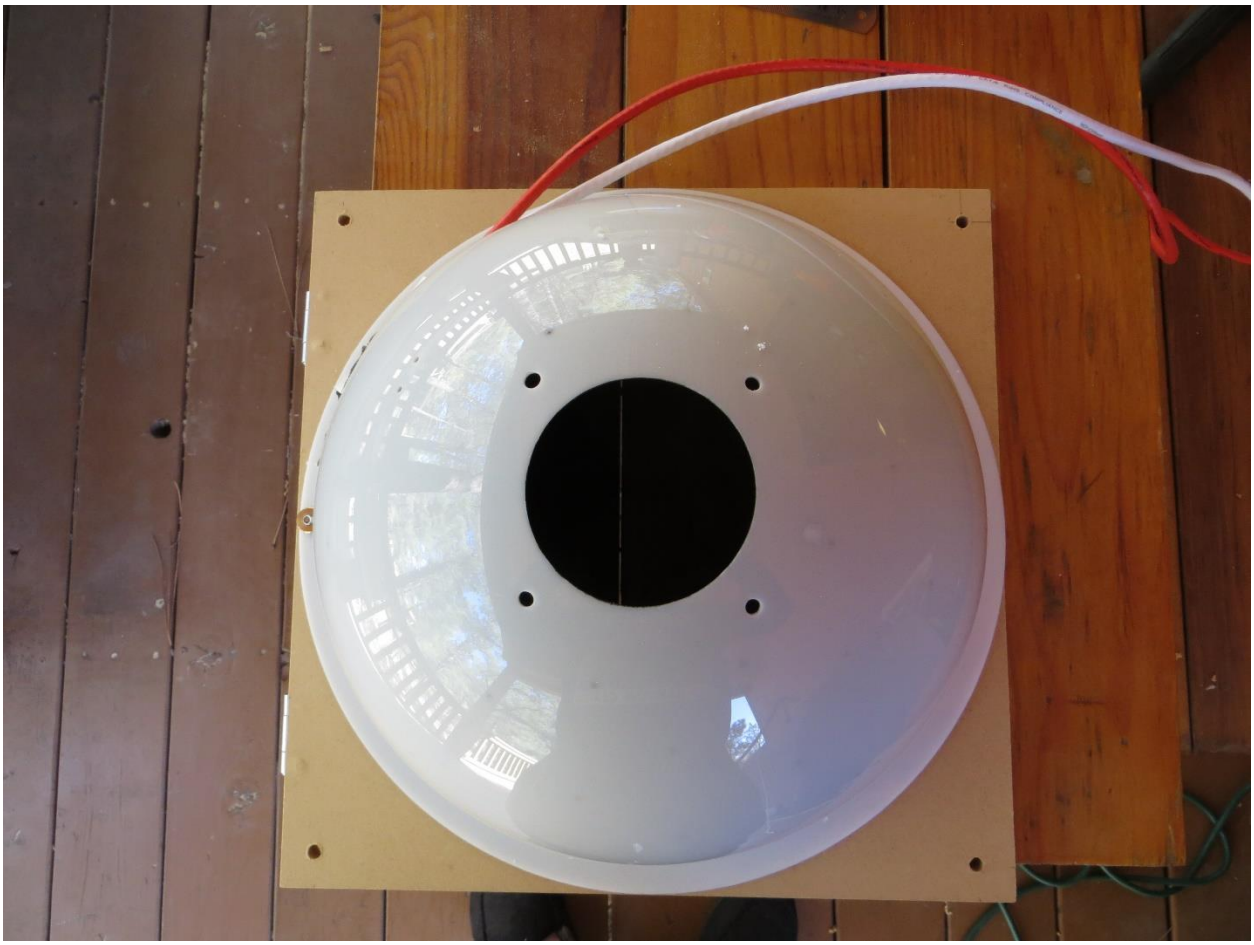
Now mark a spot on the flange of the dome so that's it centered with the camera mount holes at the top, near the cable end, as shown below. It needs to be in this location to minimize the movement of the cables as you tilt this top plate up and down. It will also make lining a camera up in the correct orientation easier in some use cases, e.g. when you use a camera on a tripod:

You want to make sure to position the marked hole so that when that hole lines up with a hole in the top plate, the dome can be correctly centered on the plate, with no part of it overlapping the edge. Wouldn't be a disaster, but wouldn't look good.

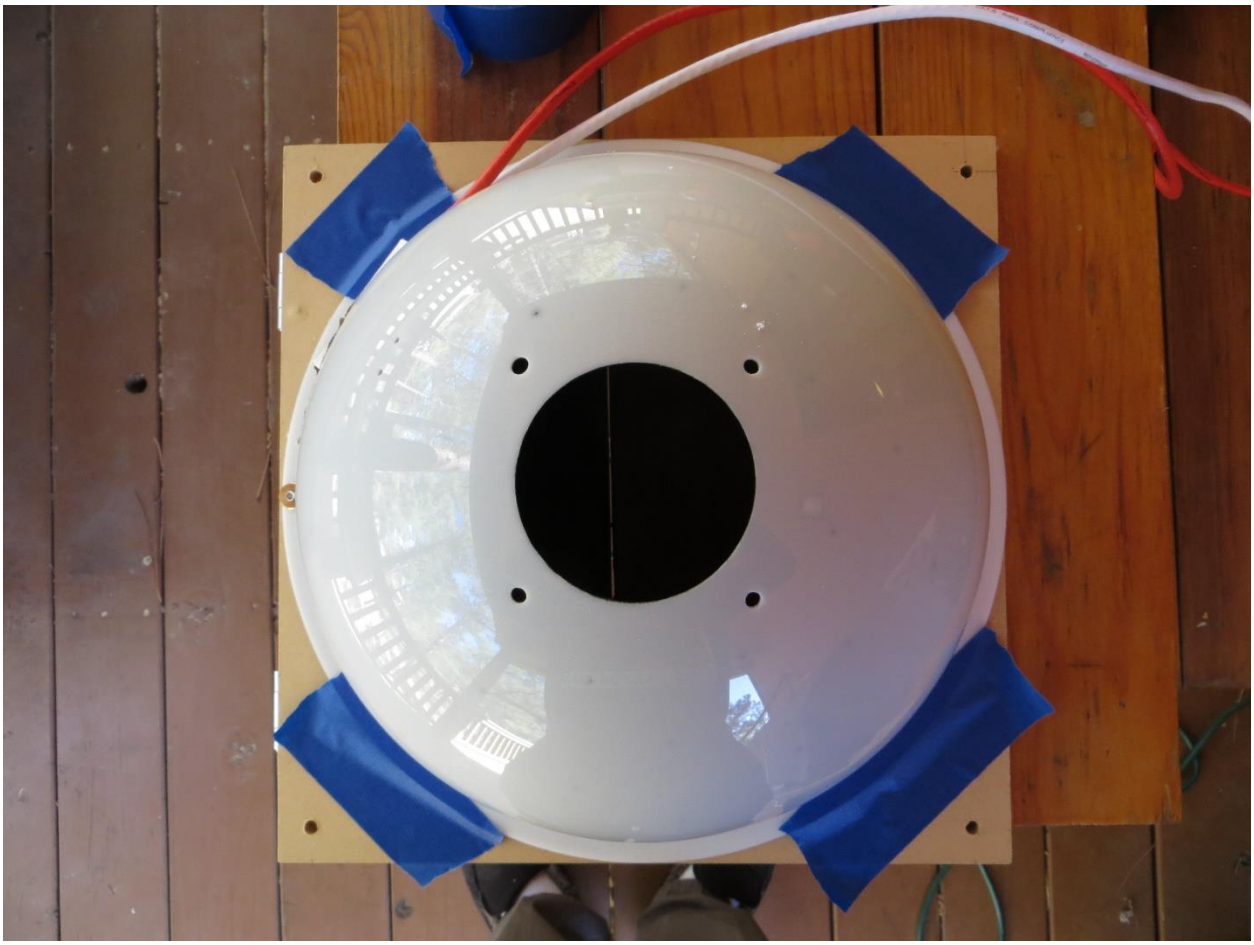
Drill a hole at the single marked position for the #10 machine screw/bolt, using first your 1/8" acrylic drill, then a step drill:

Take a 1" #10 machine bolt, run it through the hole in the top plate on the hinge side, and put the dome on the plate with the bolt going through the drilled hole; attach it with a knurled brass nut, on top of a neoprene rubber washer and metal washer. Attach the dome securely with the nut, but don't tighten it too much; acrylic doesn't like that:

The dome should be centered on the top plate, with no part of it going over the edge of the top plate. If it does overlap the edges a bit, you can drill out the dome hole slightly larger to allow you to position it correctly. The knurled nut is visible on the left, on the hinge side:

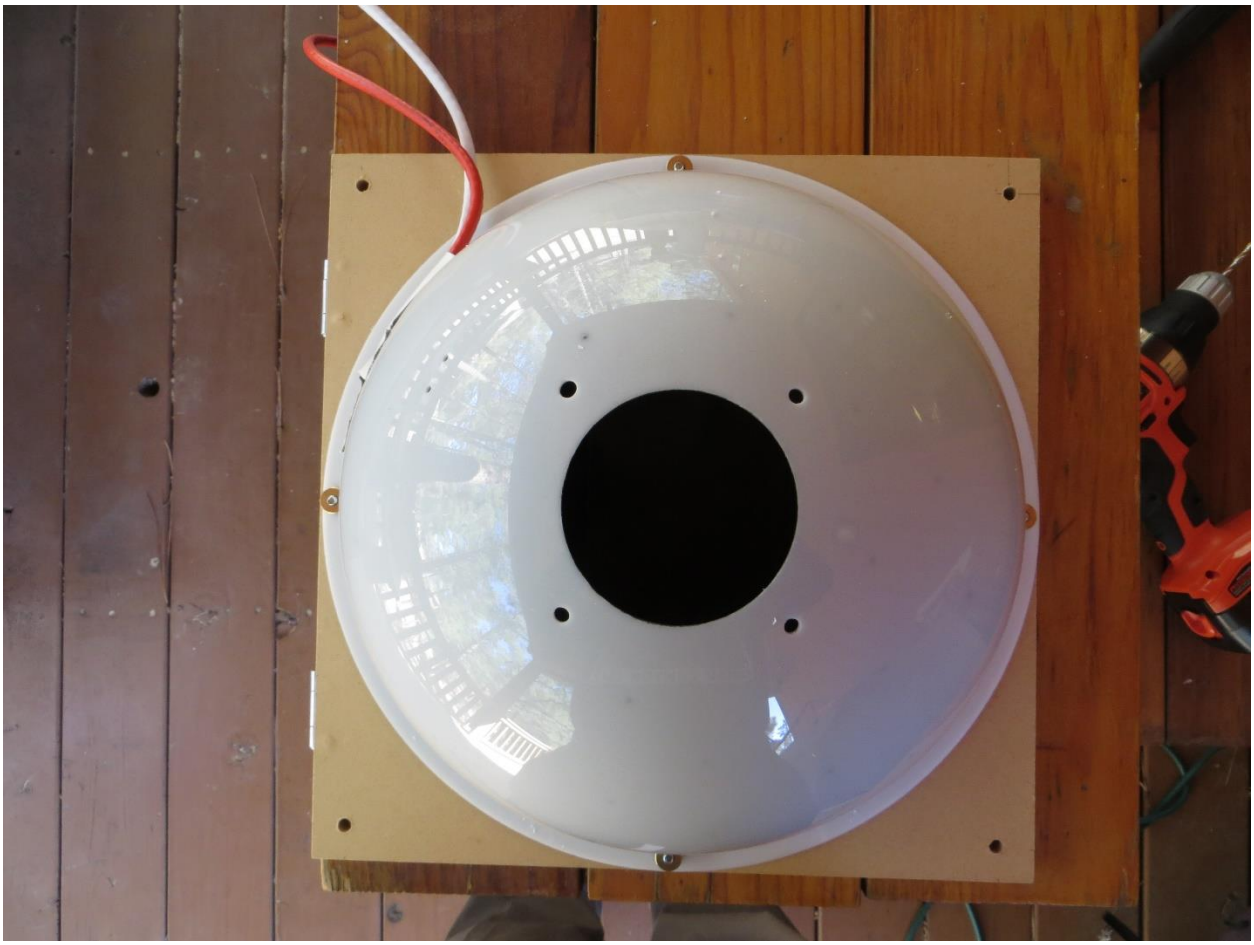


Tape the dome in place with masking tape, to hold it securely:

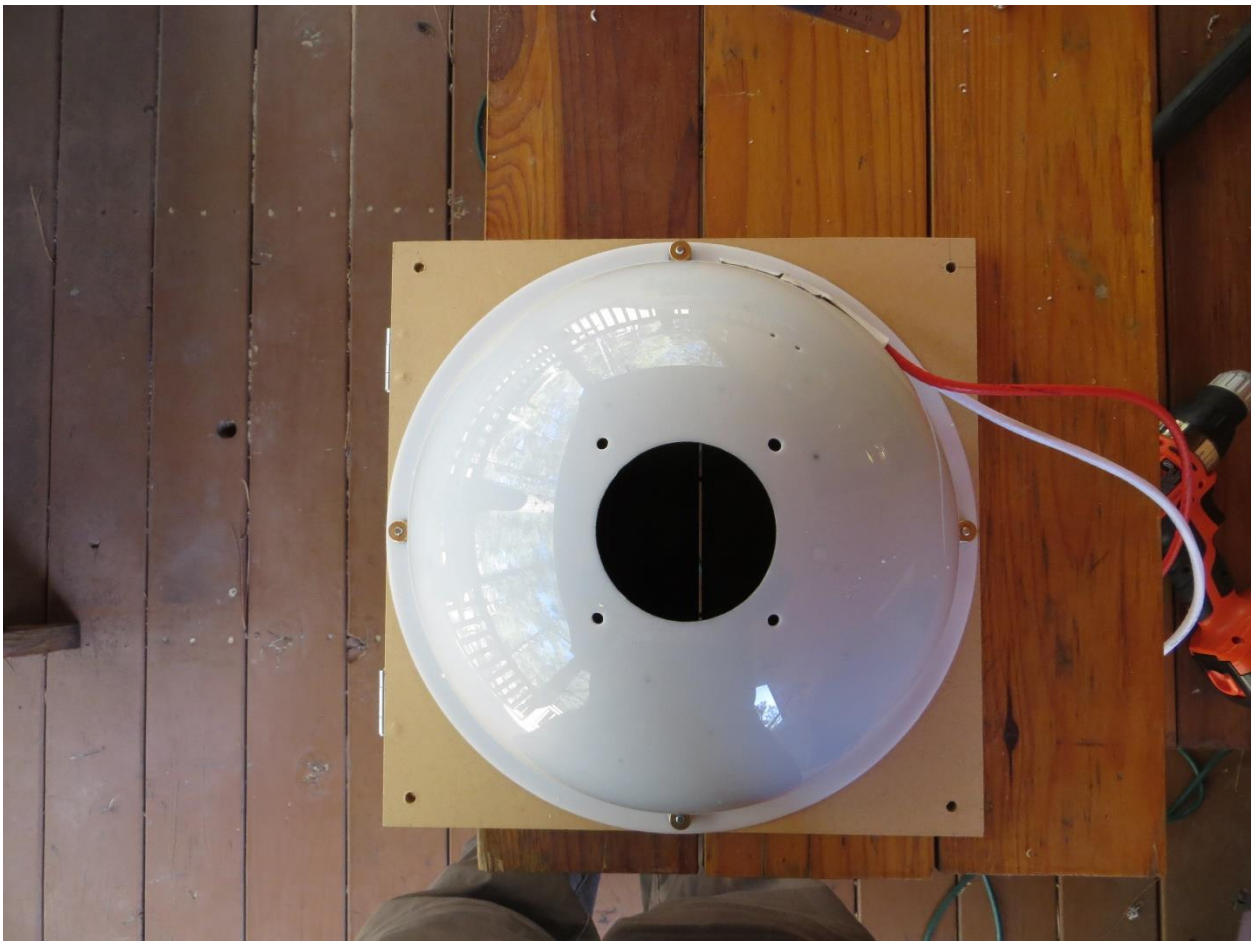


Push and twist a drill bit through the three remaining holes to mark the positions on the dome flange where you need to drill holes:

Drill holes in these position for the #10 screws, then insert the remaining bolts/knurled nuts to see if everything lines up. If not, you can drill the holes a bit larger:

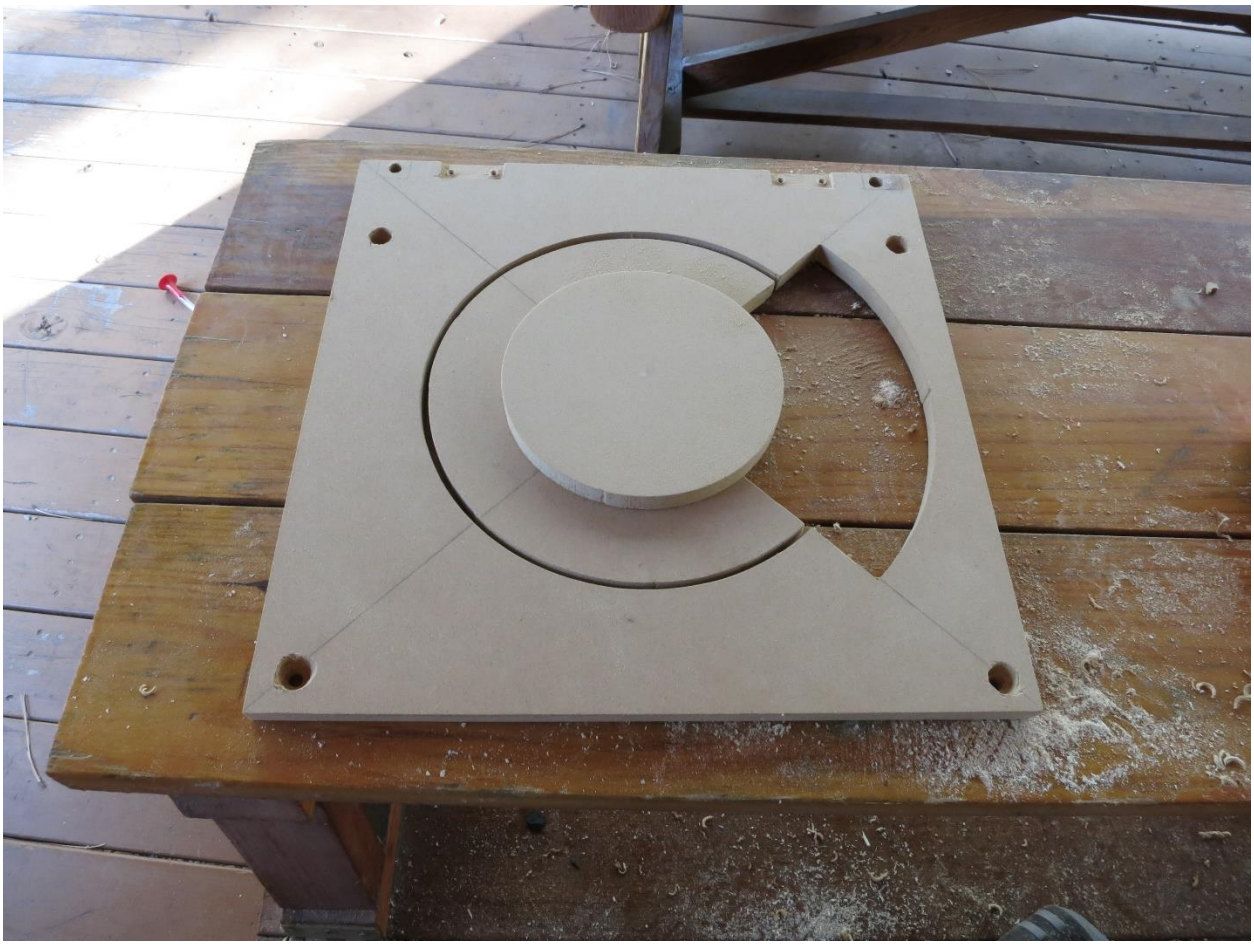


For mounting the dome vertically, it can be useful to have the dome oriented 90 degrees to the right of the current configuration. Try rotating the dome 90 degrees and seeing if the screws still line up; if not, you can drill them a bit larger:

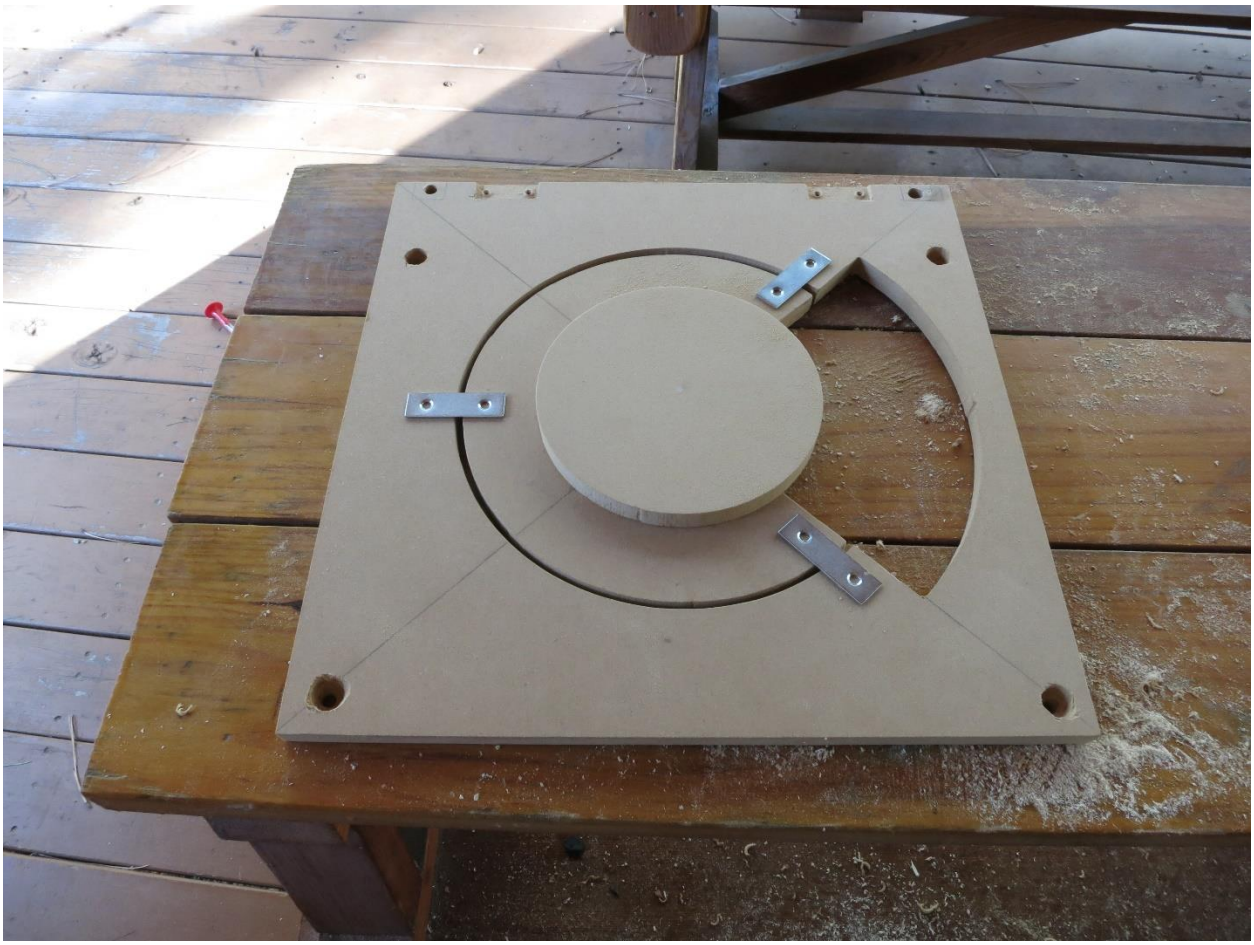


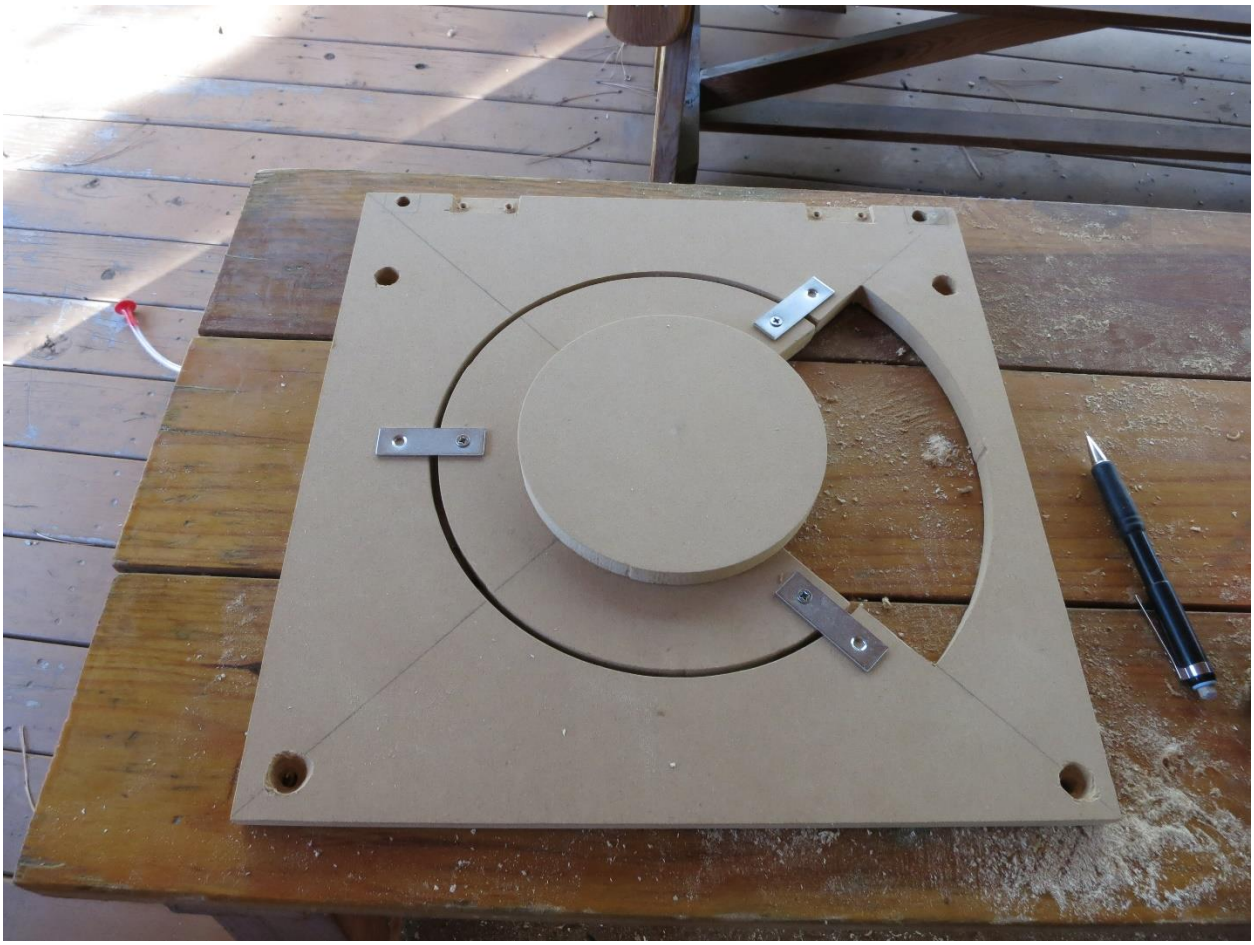
Finally, the #10 screw/bolt heads on the bottom of the top plate will keep it from sitting flat on the bottom plate. So, like the dowel bolts, you'll need to drill countersinks on the bottom of the top plate to accommodate the heads:

Next is the center plate. Grab the bottom plate, the round disk, and the center piece with the radial notch cut out. Glue the round disk to the center of the notched piece:



Take the three mending plates, and attach them to the center plate at the three positions seen below with 3/8” #6 wood screws (pre-drilling the holes will help):

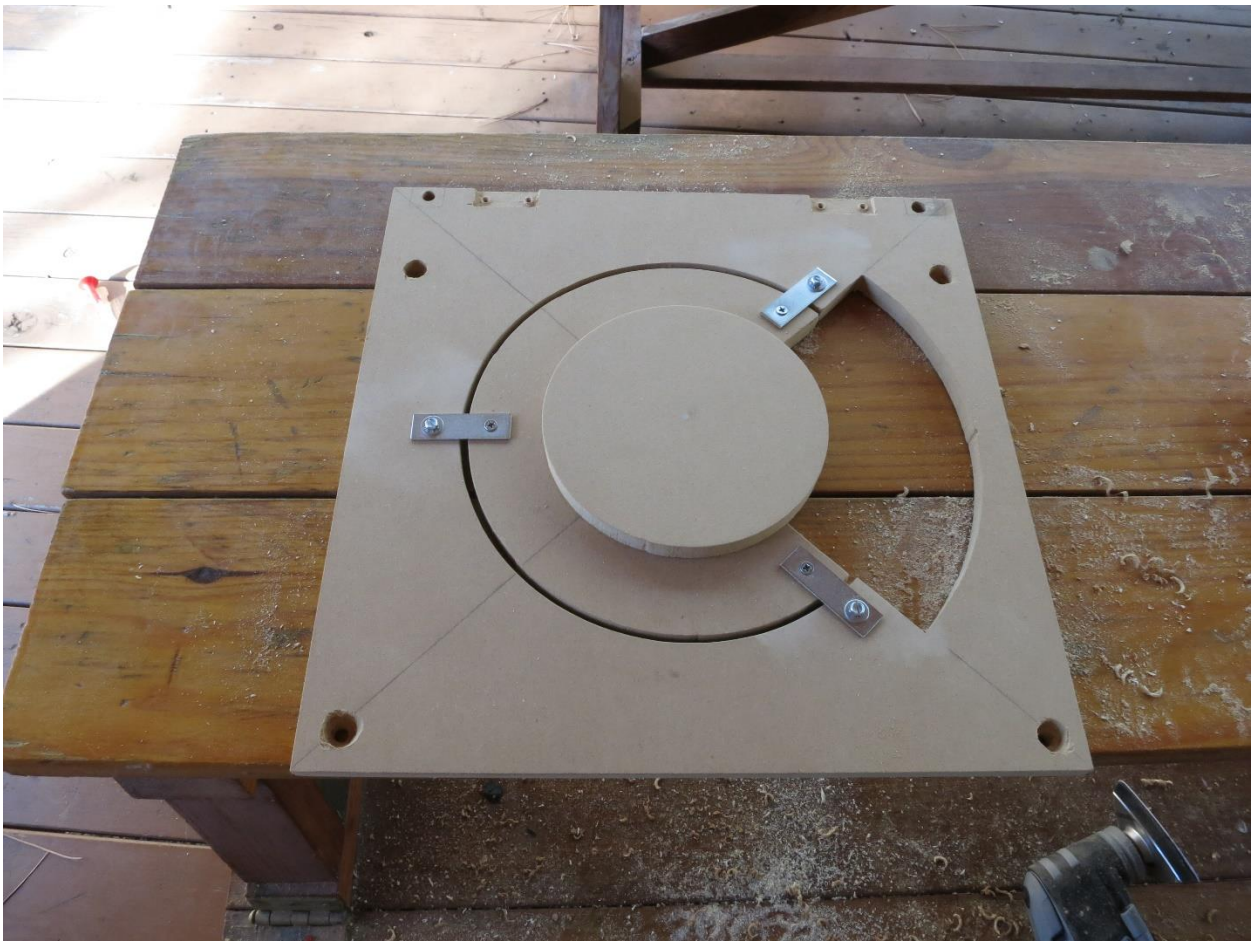




Mark a hole position for one of the three mending plates, then drill a hole for a #8 threaded brass insert in the bottom plate. Install the insert (in a similar manner to the dowel inserts), then attach the mending plate to the bottom plate using a ½" #8 machine screw:

Center the plate as best as possible, tighten the screw, then mark hole positions at the other two mending plates. Drill holes and install threaded brass inserts at the other two holes:

Then replace the center plate and install all three screws to make sure they fit, and hold the center plate securely:



The next section describes installing the braces that allow use of the dome in a vertical orientation. Even if you don't think you'll need to use it that way, I still recommend setting up the dome to allow vertical use – you never know what your system might ultimately be used for.

First, re-attach the bottom plate to the top plate at the hinges:

Note here that the dowel holes are in the correct position (and you can see where the incorrect holes were filled in with wood putty).

Now you'll need to position and size two square wooden braces (3/4" to 1") to hold the top plate (with the dome attached) vertically. Here I have two braces positioned:

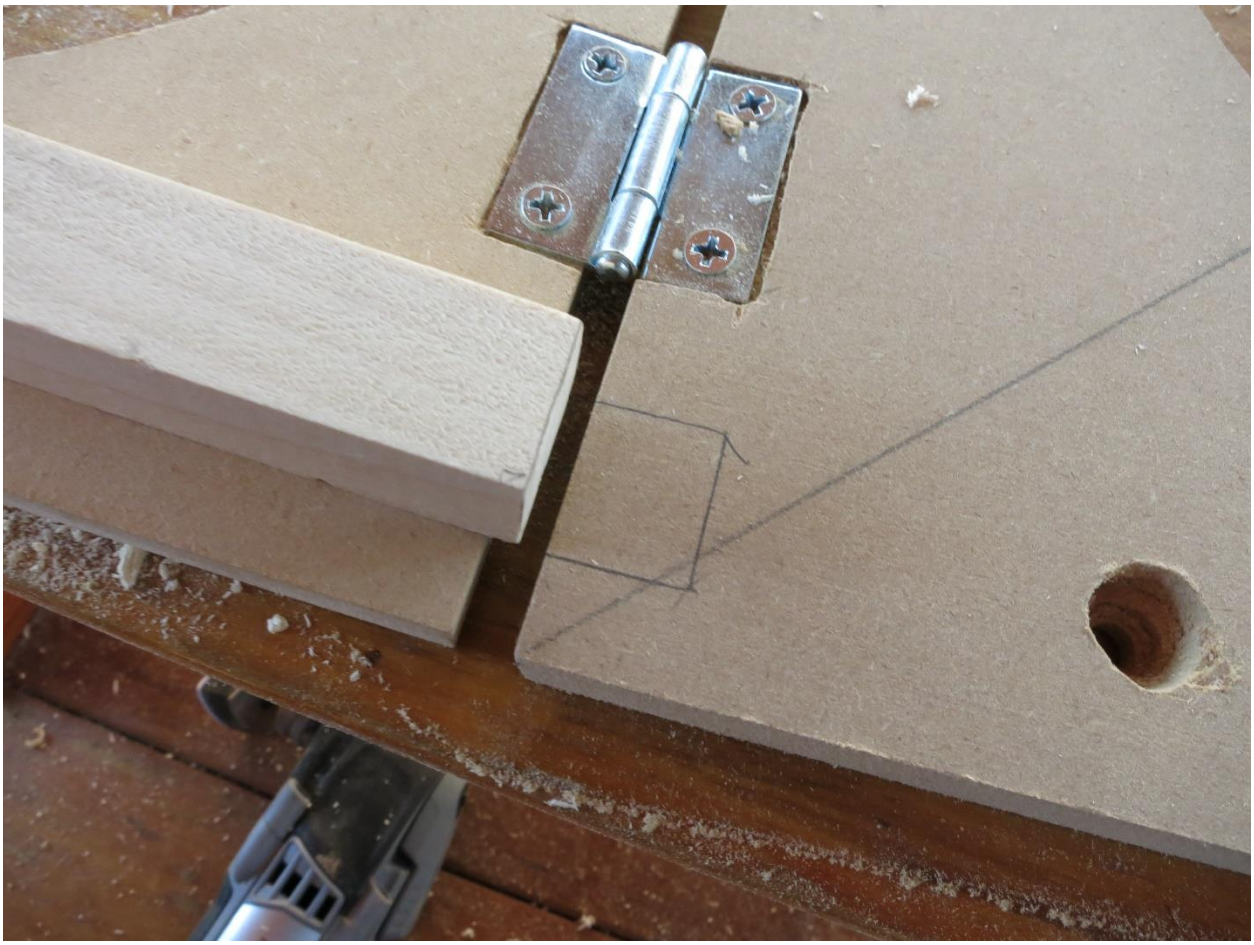
In the picture above, I have the bottom of the braces flush with the edge of the bottom plate. This was wrong – it should be lined up in the center of the gap between the top and bottom plates. As a result, the braces were too long, and the dome wouldn't fit until I sanded off some of the edges. You want the brace to be long enough to overlap the dome hole on the top plate plus a bit more, but not so long as to block the dome. About 2-3/4 or 2-7/8" is about right. You can check this by placing the dome on the top plate, lining it up with its mounting holes, then making sure the braces clear.

Take one brace, and put it in position relative to the top plate held vertically, and the dowel hole drilled in the top plate; clamp it in place:

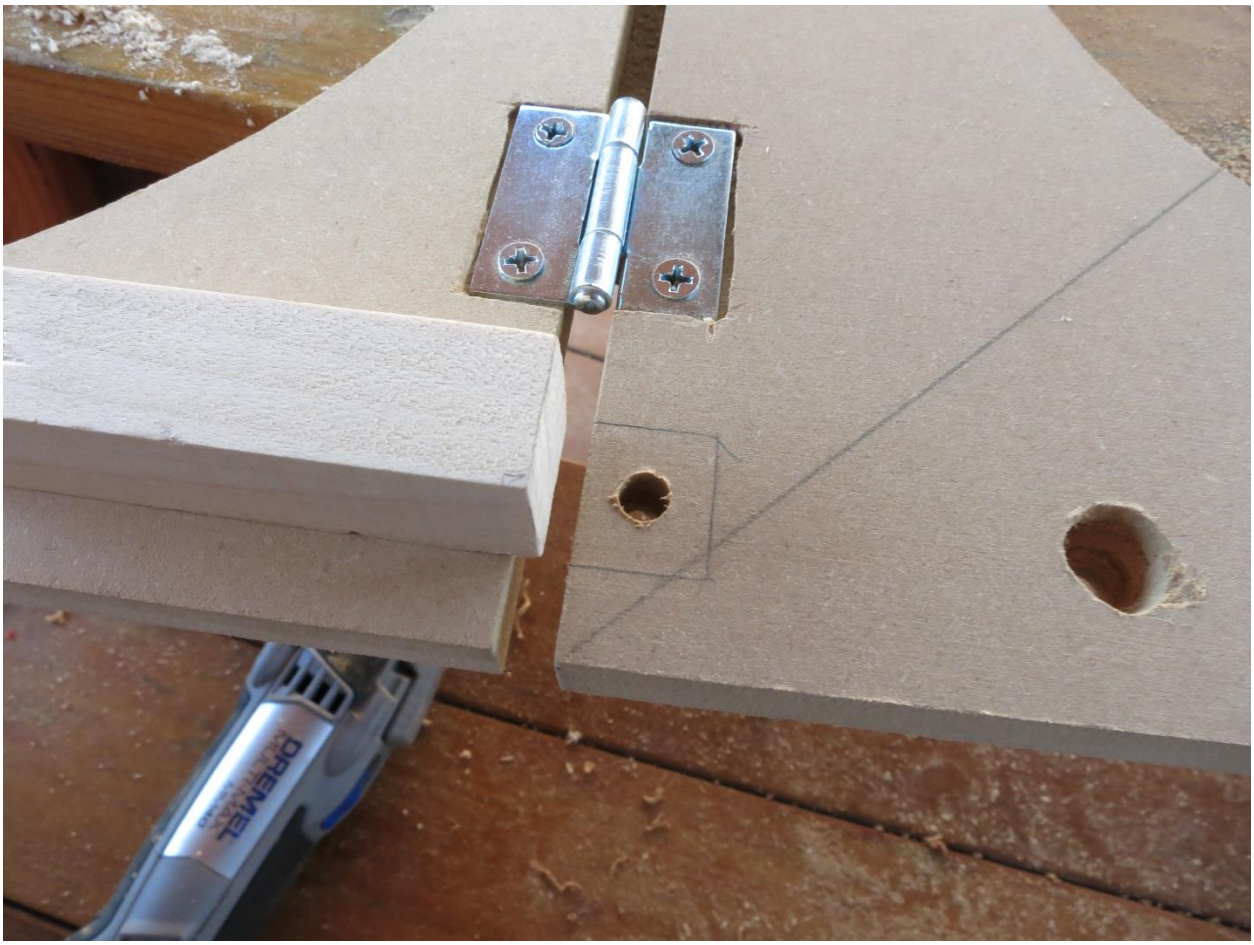
Drill a 5/16” hole through the dowel hole in the top plate, extending all the way through the brace piece on the other side:

Insert a ¼-20 threaded brass insert into the hole in the brace, then bolt the brace into place:

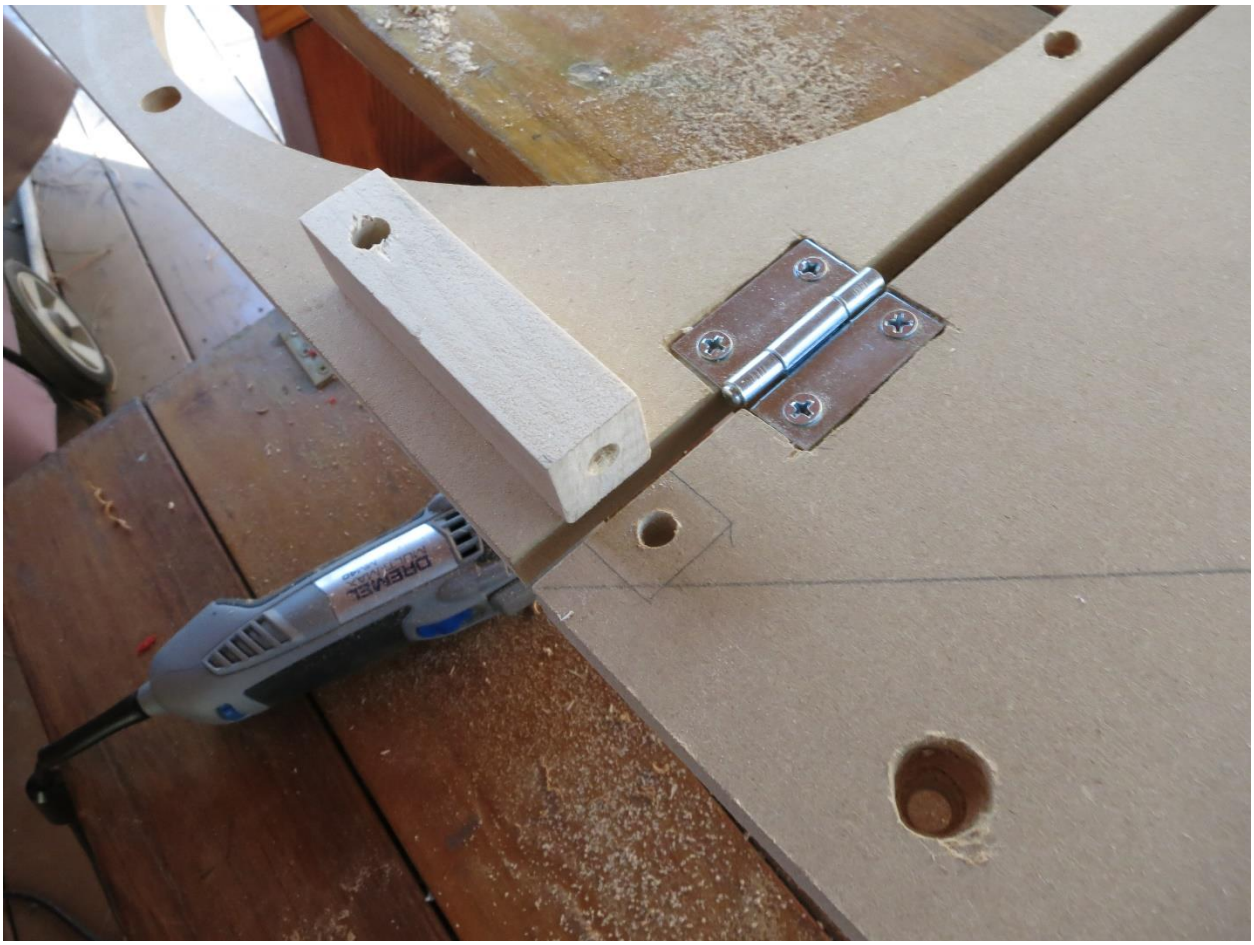
If it doesn’t fit neatly in place (or even if it does), you can drill out the hole in the top plate to 3/8” diameter to allow you more wiggle room in positioning the brace. Now trace the outline of the brace on the bottom plate:



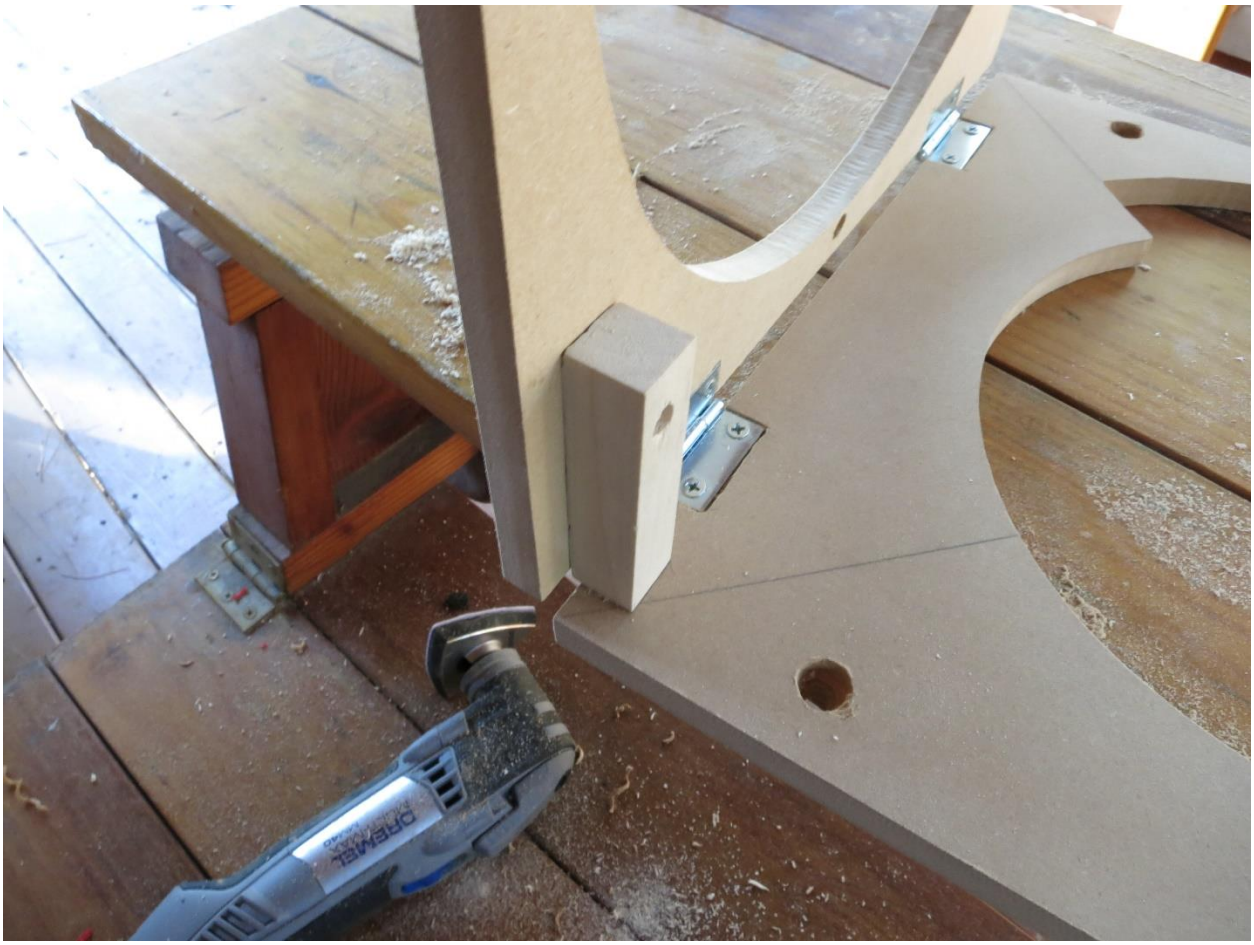
Drill a 5/16” hole in the bottom plate, roughly where the center of the brace will be:



Flip the top plate up until the bottom of the brace is against the bottom plate, then drill a 5/16” hole into the bottom of the brace using the hole in the bottom plate as a guide:



Install a ¼-20 threaded brass insert into the hole at the bottom of the brace. Bolt it back in place on the top and bottom plates to make sure it fits; you can drill out the bottom plate hole to 3/8” to give you more wiggle room in positioning the brace vertically:



Mark the bottom of the brace to identify its position (I put “L” to mark this one as the left brace).

Repeat the same procedure to install the brace on the other side.

Almost all of the parts assembly is done; now comes painting. Disassemble all parts, including the braces and hinges. The only parts that absolutely need to be painted are the bottom and center plates; these should be painted flat/matte black to reduce light scattering inside the dome. However, I recommend painting the entire stand, because it looks better, and also protects it from moisture. You can choose whatever colors you feel are appropriate. I used black for the entire bottom/center plate assembly, since that made it easier. For the rest of the dome stand, I used white, since it’s intended for both indoor and outdoor use, and white will help keep it cooler in the sunlight. If you only plan to use it indoors, use whatever colors you want. Once the paint dries, attach dense rubber padding to the bottom of the dowel stand legs, for vibration reduction and to keep the system from sliding around. Sorbothane is awesome, but expensive; Google for other vibration dampening options. Your system should always be used in a vibration-minimized environment, e.g. a sturdy heavy table sitting on a concrete floor.

Now re-assembly your stand:

1. Attach the hinges to the top and bottom plates.

2. Attach the dowel stand legs with 1” ¼-20 bolts.

3. Attach the center plate to the bottom plate with #8 screws.

4. Attach the dome to the top plate with #10 screws, neoprene and metal washers, and brass knurled nuts.

For vertical mode:

1. Remove the dome from the top plate.

2. Mount the top plate vertically with ¼-20 bolts and washers.

3. Mount the dome on the back side of the top plate.

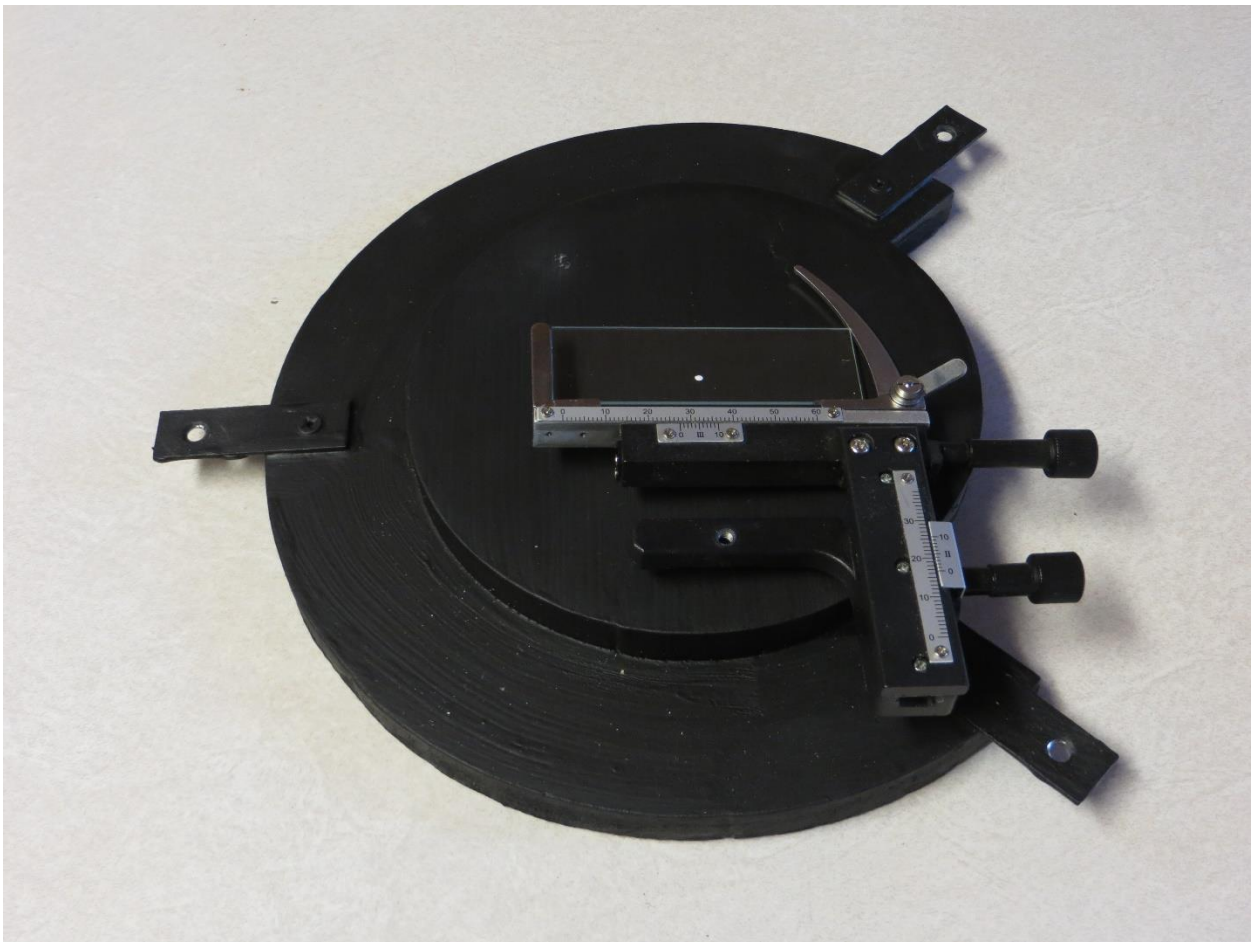
4. While the system will be fairly stable in vertical configuration, I recommend keeping the center plate in place, and putting large books or other heavy weights in place to make it more stable.

If any part of assembly is unclear, use the video as a guide to figure out where/how everything fits together.

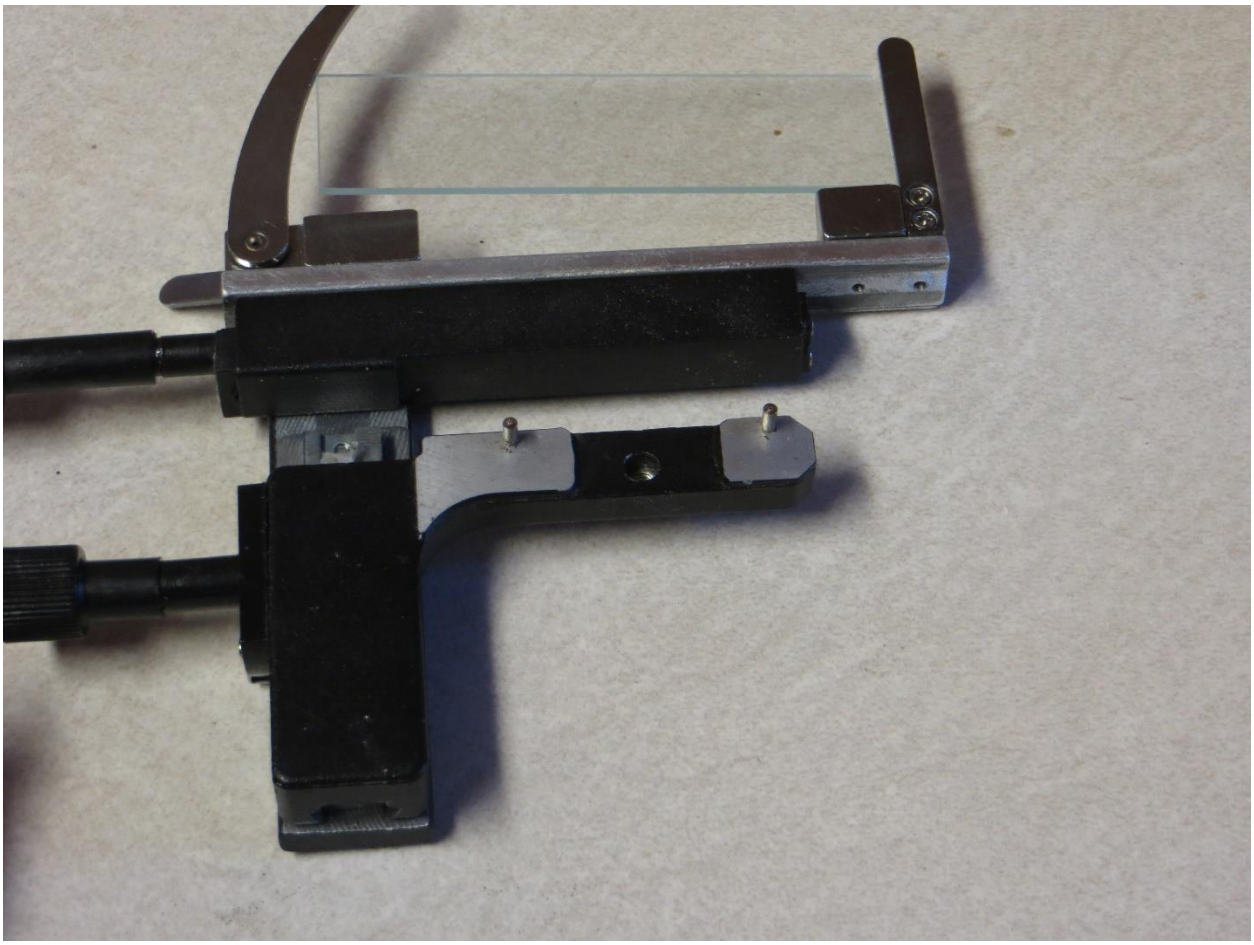
You will want to mark the center of the plate to aid in positioning samples.. Install the camera at the top of the dome. I put a small washer on the center plate, and centered the washer in the camera view. I then marked the center of the hole of the washer with a bit of white paint dabbed with a toothpick:

You can place the samples directly on the wooden disk, but I usually put some kind of smoother black/gray material on the disk to serve as a less-textured background.

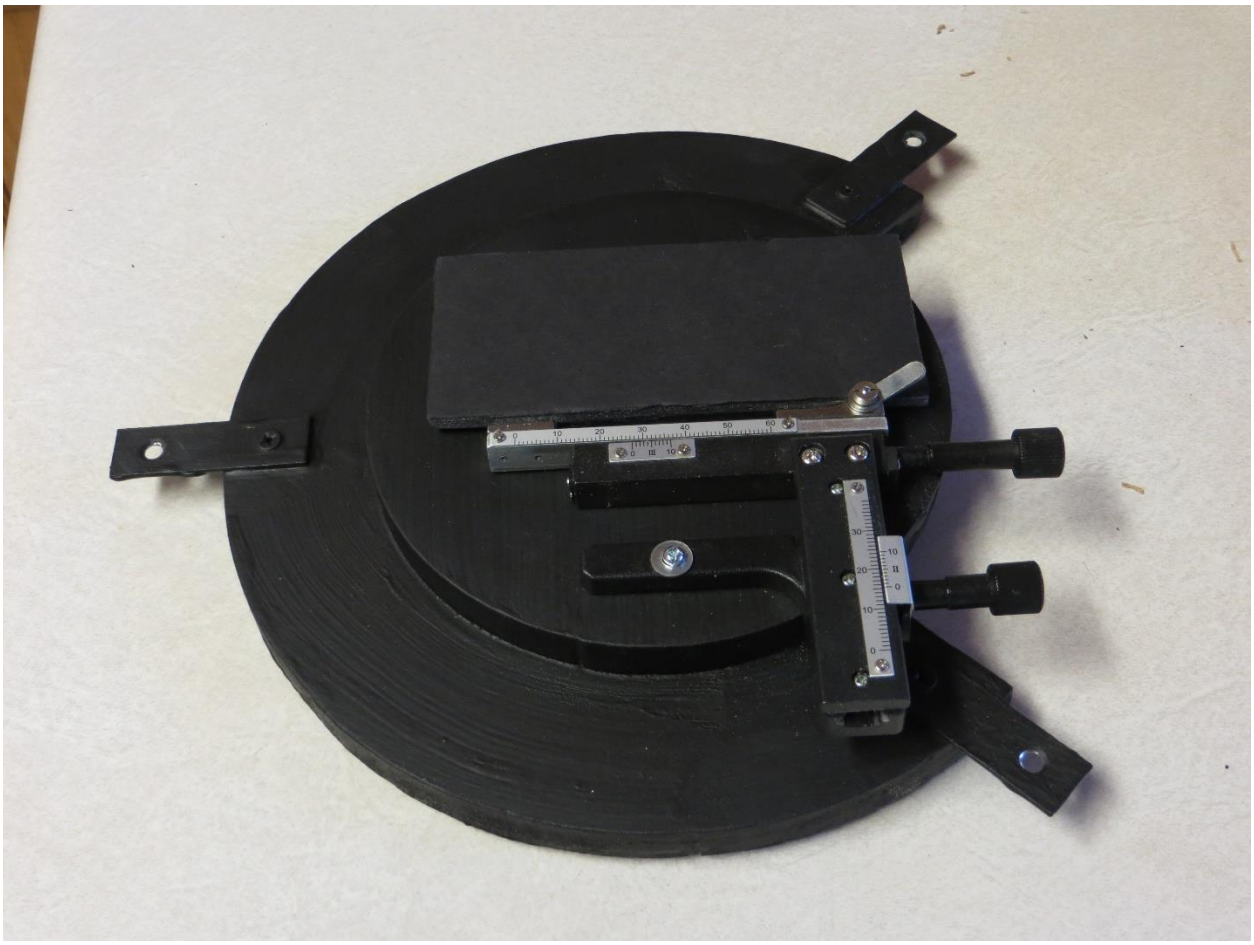
One final optional step. If you plan to use either a macro lens or a USB microscope with this system, you'll want some way to accurately position your sample in place. I use an inexpensive micrometer stage intended for use with lab microscopes for this. Position the micrometer X-Y screws so that the stage is in the center position, put a glass slide into its holder, and place it on the center plate so that the center of the glass slide is at the center of the center plate:



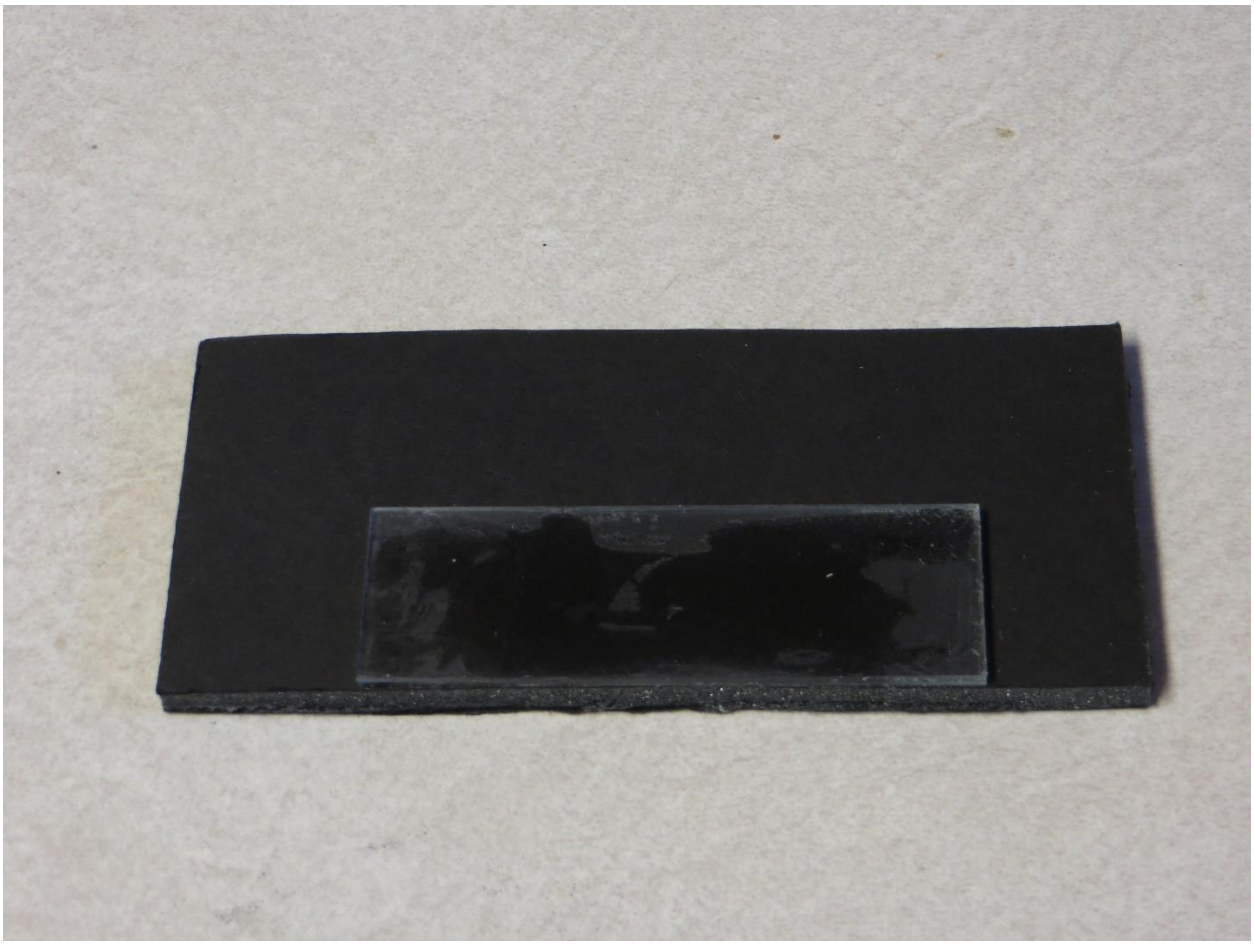
Mark the position of the center screw hole, and drill a hole for a #4 machine screw. On the underside of the micrometer stage, there are two positioning pins:



You'll need to drill holes in the center disk to accommodate those. The simplest way is to attach the micrometer stage with the screw to the center plate, lining it up as in the second picture above. Then press on the micrometer stage so that the pins make minor indentations in the center plate. You can then drill holes at the indentations that the pins can drop into, and install the micrometer stage:



While you can attach small samples directly to a glass slide in the micrometer stage, I use a piece of black posterboard with a glass slide glued underneath to make a larger sample stage:



The glass slide fits in the micrometer stage, and the entire posterboard piece moves with it.

Finally, the 1.5” ¼-20 bolts with washers and wing nuts can be fastened through the holes running through both the top and bottom plates to keep the system secure during transportation.